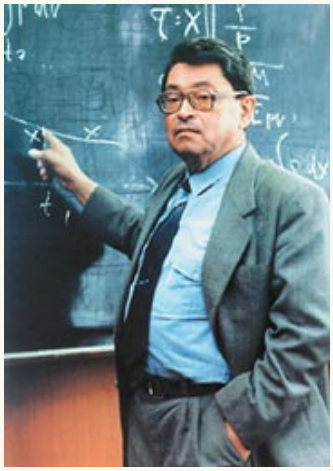
to Home Page

Physics | Astronomy | Geosciences | Chemistry
Technology | Psychology | Economy | Miscellaneous
Biology | Medicine | Story | Social sciencies

Vladimir Gubarev

Academician Yuri Trutnev: “Endless front of work”

Andrei Dmitrievich Sakharov left an inheritance to each of us. One - his own understanding of the world and society, another - conscientiousness, a third - courage and the ability to fight, and all together - that very “Sakharov’s world”, which has already become an exciting page in the history of not only our Motherland, but also the life of humanity in the 20th century.



Academician Yuri Alekseevich Trutnev.

Yuri Alekseevich Trutnev also inherited responsibility for the fate of nuclear and thermonuclear weapons, which were created under the leadership of Academician Sakharov. Still, we should not forget that he was not only a great humanist, but also an equally great theoretical physicist. Trutnev is not just Sakharov’s colleague, his ally (they worked together for many years and last met a few days before the death of Andrei Dmitrievich) , but most importantly, a like-minded person. Yes, we didn’t always agree, yes, we argued, but we always found a common point of view. Both in science and in politics. Therefore, Yuri Trutnev today occupies the same position at the Federal Nuclear Center (All-Russian Research Institute of Experimental Physics) and the same position that previously belonged to Sakharov. Academician Trutnev looks tired. He has just returned from Moscow. The Russian government held a regular meeting at which disarmament problems were discussed, and again - for the umpteenth time!

— I had to listen to different opinions about the fate of nuclear weapons. It’s difficult for Yuri Alekseevich because his views are unusual, and some colleagues and members of the public are critical of them. You can, of course, give in to one or the other, but this is not in Trutnev’s character - we remember whose inheritance fell on his shoulders!

— As far as I know, you, Yuri Alekseevich, have a special point of view on nuclear disarmament?

— Why “special”? I just think as a citizen and a specialist. The fact is that the already familiar words are heard addressed to us: “They should just blow things up!” They attribute to us the fear of losing our jobs and so on. We will never lose our jobs even if we stop working on weapons. Our specialty is such a broad profile - it is connected with various areas of physics, technologies, designs, that we will always find a use for our strengths, and partly this is already happening. It is important to understand that arms reduction is a completely natural process. So talk about job loss and a “thirst to blow up” is often not just incompetence, but a desire to gain political capital. It is fashionable to criticize nuclear weapons and those who dealt with military issues. But we must not forget that in our world - complex, riddled with crises - the country still needs defense. And nuclear weapons, from my point of view, are the cheapest way to prevent any threats, any difficulties. Nuclear weapons are also political weapons. It forces a possible aggressor to think seriously before starting a conflict with a country where it exists. For us, nuclear weapons are of particular importance - such is the geopolitical position of the country. It’s good for the Americans - they sit across three oceans, and we are in the very center of the continent. And who said it was calm?! Let's remember borders and territorial claims. I am not speaking from the point of view of any imperial ambitions, but simply stating reality.

— Are you concerned about the current state of affairs in Russia?

- Certainly. The crisis is deep. In addition, we must live not only for today. And what to expect in the future is still unknown. At least the Americans are not going to give up nuclear weapons, we are only talking about reduction. And I think this is correct. Why was there an arms race, why were so many nuclear weapons accumulated? These questions should not be answered by scientists. Claims must be made to politicians, because the development of events depended primarily on them.

— **Were you just performers? Or did they, to some extent, determine the country’s nuclear strategy?**

— Of course, we did not define it, but our work influenced the behavior of political figures. I’m not going to make excuses; moreover, I don’t regret at all that I took part in the creation of weapons. We worked to strengthen the country’s defense capability, and without sparing ourselves. Together with the entire country, because nuclear weapons are the work of many thousands of people. And our conscience is clear, since we did not have Hiroshima and Nagasaki. And there have never been any accidents with weapons... Where is the tree, I’ll knock...

— **I know that recently a group of Russian specialists was invited to the United States, where they were shown ways and means of dealing with such accidents. So to speak, the Americans shared their own sad experiences.**

— Fortunately, we didn’t have such serious accidents... Well, what now? It seems to me that nuclear weapons will exist for quite a long time. They say: “weapons of mass destruction.” What happened to Dresden? How many residents died there as a result of “carpet bombings”? About forty thousand... This is without any atomic bomb. And in Iraq?... Of course, nuclear weapons have special properties, a multifactorial impact, but modern types of weapons too, I would say...

-... **not a gift!**

- That's it! So it is necessary to think much more broadly, not focusing only on nuclear weapons. In my opinion, the future of nuclear weapons is, first of all, reducing the number of ammunition, increasing the safety of its storage, especially in our country, and creating new, more reliable types.

- **In this case, are tests necessary?**

— Weapons cannot exist without them. I sometimes hear that it is possible to create weapons and not test them. And they refer to Andrei Dmitrievich Sakharov. I talked to him about this three days before he died. He did not change his point of view, although I tried to convince him and recalled several cases from our joint work. I have deep respect for Andrei Dmitrievich, I am his student, but in this case he is wrong. If you approach weapons as a technical means, then you cannot do without testing... By the way, the most curious thing is that those who have nothing to do with the creation of weapons are starting to talk about this... In fact, the issue of testing is highly politicized. Yes, there were air tests. That's one thing. Underground is completely different. Even in that memorable conversation, Andrei Dmitrievich admitted that underground nuclear explosions are safe. I say this for those who are accustomed to referring to authorities.

- **But this is if there are security guarantees?**

— We have technology that provides that there will be no emissions at all. For some reason it is still classified. I believe that all this data should be brought to the attention of the public who are discussing the trials. Why hide something new?!

I want to emphasize that a professional army must deal with nuclear weapons, and responsibility is required when handling them. And a strategy of flexible containment and flexible response must be chosen. These goals will be met by troops equipped with nuclear weapons... They often say: who is going to attack us? If you follow this logic, then there is no need for an army or weapons. The weaker we are, the more temptations there will be - in my opinion, this is clear.

— **Yuri Alekseevich, there are rumors that the idea of retargeting our missiles from targets in the United States, which Yeltsin announced, is yours? This proposal, as is known, caused a lot of misunderstandings in the world; moreover, some considered the idea adventurous.**

- I can only say one thing. That statement by the President spoke about the elimination of anti-American targeting, that is, the removal of flight missions from missiles aimed at the United States. But the press turned everything upside down, saying, let’s redirect it from cities to

military installations. This is stupidity, because shooting at cities or military targets is the same thing; radioactive contamination will be everywhere. But to exclude the possibility of shooting altogether is a completely different matter! I believe that this was a political step, a step of goodwill. It was necessary to show that we are not opponents. And frankly, one could have expected a response, but, unfortunately, there was none - American missiles are still aimed at us.

— **You mentioned that “we need to deal with the safety of weapons, especially in our country.” What exactly did you mean?**

— Not the weapon itself, but the situation developing in Russia and the republics of the former Soviet Union. A decline in discipline, the possibility of accidents during transportation, and so on.

Director of VNIIEF academician Radiy Ivanovich Ilkaev and Yuri Alekseevich Trutnev.

— **Because of the collapse in the country, is there a danger of a “careless” attitude towards weapons?**

- No, you can’t say that. On the contrary, today measures to prevent such accidents are becoming more stringent. The military does most of the work, and we support them with technical means.

— **Did you come to the All-Russian Research Institute of Experimental Physics as an ordinary engineer?**

- Laboratory assistant.

- And now?

— First Deputy Scientific Director.

- I know that in Arzamas-16 they don’t chase titles and awards - they are given. What are yours?

- Academician. Ph.D. I never applied for the title of “professor” - there was no time, and I don’t attach any importance to it. Laureate of Lenin and State Prizes. Hero of Socialist Labor... And so on. Why ask about this?

Two outstanding Russian physicists - Zhores Ivanovich Alferov and Yuri Alekseevich Trutnev (Sarov , 2002) .

— **To ask the following question: what is the most valuable award for you?**

- When you get what you think. I don’t mean an award, but the implementation of a scientific idea.

— **When did you first feel this?**

- For real, for the first time in 1958 ... No, excuse me, earlier... in 1955!.. Then we had a real technological breakthrough - we implemented one idea to which I was most directly related.



A model of the RDS-37 thermonuclear charge is on display at the Nuclear Weapons Museum of the All-Russian Research Institute of Experimental Physics. The real charge was detonated on November 22, 1955. The photo on the right shows two phases of the explosion.

— **Sometimes nuclear scientists are called “blind hawks.” Is it offensive to read and hear this?**

- It’s not so much a shame for ourselves - we’ve been through other things. But I’m bitter about the speculation around weapons, about the atmosphere in the country and in science. Everyone is looking for the reason why their lives have become worse: who is to blame? And then there’s the answer: the military-industrial complex. He, they say, devoured everything... And from here comes anger, ill will, even meanness. But this is not so! There is a substitution of concepts - “effect” is swapped with “cause”. Political games again.

— **Do you think the creation of nuclear weapons made it possible to break into new areas of natural science?**

- Undoubtedly. We have to deal with physical phenomena that cannot be reproduced in laboratory conditions. Temperatures - tens, hundreds of millions of degrees, pressures - billions of atmospheres, densities - hundreds of thousands of grams per cubic centimeter, times - hundred-millionths of a second... Completely new areas of physics have appeared here.

— **What is “hundred-millionths of a second”? How to understand and comprehend this?**

- It is necessary to comprehend in order to make calculations. But, of course, it is impossible to feel it.

— **When you dive into calculations, don’t you get the feeling that you are living in another world?**

- I think no. Psychology doesn't change.

- **Although, probably, we all live in a world that is difficult to understand. Here the Sun is shining, and inside it the temperatures are approximately the same...**

- Not exactly... Now I’ll count... No, at the center of the Sun there are only millions of degrees. Not tens, not hundreds of millions...

- **So, the Sun is a relatively simple device compared to an atomic bomb?**

- No, that's not true! The sun is still a completely unknown object. It is an overly complex system... Everything is simple when you understand how it works... You talk to physicists who work on elementary particles, vacuum, and so on. The abstraction there is so great that it’s hard to imagine! Compared to their constructions, our millions of degrees and billions of atmospheres

are simple because they are understandable. We are still capable of creating models, but even this is impossible for them - you can’t explain anything with your fingers...

— **Let’s conduct a small experiment: let’s move forward 500 years. Do you think current work in physics, in particular on nuclear weapons, will be useful to scientists of that time?**

— Is what happened 500 years ago necessary today?

- There was a Renaissance...

- And now is the era of the scientific and technological revolution!... They will simply look at our affairs with different eyes, understanding the incompleteness of our knowledge... Different historical conditions, people, tasks, interests... Each time has its own...

— **You have been in Arzamas-16 for a long time. Obviously, there were different periods - some were better, then worse. For you personally, when was the hardest time?**

- At the beginning. At the university they taught it in a scholarly manner, but here the knowledge had to be applied in practice. And even now young people arrive, and it turns out that they need to be retrained right away... At different times it was hard and good, easy and difficult - always in different ways... Life is life, it’s difficult to single out anything from it ... Now, of course, more difficulties. And sometimes you don’t know how to overcome them. You look for a solution, you find it, you make a mistake, you look again - there are no recipes .

- You are a student of Sakharov...

- Not only him, but also Zeldovich, Frank-Kamenetsky, Khariton - I had to learn from many.

— **Which of them had the greatest influence on you?**

— At the very early stage, when I first arrived here, — David Albertovich Frank-Kamenetsky. An exceptionally educated person, an intellectual. Very kind. An excellent physicist. He helped me a lot... Our rooms were cramped then, small, and he sat me opposite. And he simply began to quietly teach me how to work. At the same time, he brought books that were not directly related to our business, and could read Gumilyov’s poems at the height of the working day... He treated us like a father , I learned a lot from him in a scientific and everyday sense.

- Excuse me, what was Gumilyov like at that time?! You live in a closed city, you are being bugged not only at work, but also at home?!

— Whether they were wiretapped or not, I don’t know. This did not affect us. Moreover, political issues were discussed much more openly here than on the mainland. We were working on a problem of national importance, and therefore the attitude towards us was different from the others. Freedom of thinking in physics is inevitably associated with free thinking in everything, including politics. We were not afraid, we did not think cautiously. And besides everything else, a lot of intelligent people worked here - world-famous scientists, and therefore the atmosphere was both friendly and creative. She forced us to show initiative and ingenuity - everyone tried to give a fresh idea. First of all, a person was valued for his ideas, for their development.

— **Was it difficult to make a career here?**

- We didn't think about it. I have employees who have done a lot, and they are not even candidates of science or doctors, although they can be immediately elected as

Just the facts:

- *During the “thermonuclear fever” period of 1956–1958 . 59 nuclear tests were carried out in the USSR. In 1958, a new type of thermonuclear charge, “product 49,” was tested. The ideologists of this project and the developers of the physical charge circuit were Yu.A. Trutnev and Yu.N. Babaev. For the creation of “product 49” they were awarded the Lenin Prize...*
- *During the period 1958 and 1961–1962 . Yu.A. Trutnev was the most active and effective developer of thermonuclear weapons. Of the 73 nuclear tests of thermonuclear two-stage charges carried out during this period, 45 tested developments of the All-Russian Research Institute of Experimental Physics, while in 28 tests these were developments with the personal participation of Yu.A. Trutnev, and 27 of them were successful. There was nothing like this either before or since.*
- *In 1965, two theoretical sectors led by Ya.B. Zeldovich and A.D. Sakharov, united. The theoretical physicists were headed by Yu.A. Trutnev. In 1964 he was elected*

academicians. They just live for work. I believe that Arzamas-16 , our institute, is not inferior, for example, to the Siberian Branch of the Academy of Sciences. By the number of qualified personnel, by the variety of topics.

a corresponding member of the USSR Academy of Sciences.

— **What do you spend more time on: scientific work or walking around your offices?**

— We have to think about work for employees due to the reduction of the main topic and raise money. We need agreements, we have to look for them.

— **Is the problem of “brain drain” far-fetched?**

— Much will depend on how events develop. I personally think that it is unlikely that our people will leave, although I cannot rule it out. After all, many of those who worked in Arzamas-16 are now “abroad” - I mean Ukraine, Kazakhstan, Belarus... But this is not the main thing.

— **Isn’t the fate of weapons outside Russia important?**

“Politicians will solve this problem.” I'm worried about something else. Over the decades, we have developed a unique scientific and technical team that brings together professionals from various specialties. This is the specificity of nuclear weapons, the creation of which brought together theoretical physicists, experimenters, technologists, designers, chemists, and so on. I am afraid that this conglomerate will fall apart in the modern environment. And this will be a loss not only for Russia, but for all world science.

— **Do Americans think the same?**

— Arzamas-16 , now Sarov, is the world's largest center of science. Our American colleagues completely agree with this and appreciate our work extremely highly.

— **Who do you think understands each other better: Russian and American politicians or you, nuclear weapons specialists?**

— I don’t know about politicians, but we always find a common language with American specialists. We talk like colleagues who know each other's work well.

— **Isn’t it strange that you are being released to America? Have you started to trust more, they say, you won’t run away?!**

— They always trusted us, it’s simply impossible to do otherwise. But times have changed, “at the top” they realized that scientific contacts need to be developed, but there is no need for us to run away... Finally, they understood it!

- Let's go back to the past. You talked about Frank-Kamenetsky. Now it’s Yakov Borisovich’s turn.

— Zeldovich is an exceptional person and an outstanding physicist. He was able to explain the most complex phenomena simply, clearly, and literally show them on his fingers. We treated him as a major scientist, but there was no “wall” between us. Everyone is equal at work. And when you feel the benevolence of a leader, when you come to him with an idea or an everyday question and you know that he will definitely help and support, then this creates a special atmosphere... Yakov Borisovich was a very witty person, he loved Saltykov-Shchedrin, and often quoted him. Always to the point and to the point.

— **Did he change when he left the “facility”?**

- No. I congratulated him very warmly when I was fifty. He helped if we turned to him. And we never forgot about him. Remember when he was in trouble? Purely political...

“ **I was partly to blame for them.” After all, I published a conversation with Zeldovich in Komsomolskaya Pravda. The party Central Committee did not like the headline very much, and from there soon came an order to “condemn Zeldovich as an idealist.” And I came up with the name of our conversation myself at the last moment and did not agree on it with Yakov Borisovich. The headline was: “When the Universe did not yet exist...” So the party ideologists found fault with it.**

“Then we wrote letters to Kommunist in his defense, but they were not published.

—What **was Sakharov like?**

“At first we didn’t know what was going on in the neighboring departments, and therefore we didn’t suspect what Sakharov and his group were doing. And then, in 1953 or even earlier, they began to interact... Andrei Dmitrievich was then a completely different person than the one everyone knows. This can be seen even from the photographs... We worked very closely and fully felt the happiness of communicating with him. We had a trusting relationship. They talked about everything: from nuclear charges to political issues... What is characteristic of him? He knew how to see the essence of the question, and he already had an answer ready. It's amazing! He was inventive, he had a huge number of ideas! Many of our departments still live on his ideas and develop them. Suffice it to say that together with Tamm he proposed Tokamak. Laser thermonuclear fusion, the ideas associated with it - it was just born before my eyes... Well, and the first hydrogen, thermonuclear bomb - he was one of those who invented it... Sakharov largely supported our endeavors. I had a friend, Yuri Nikolaevich Babaev. We were able to take a slightly different look at what was before, and a new design appeared that underlies a number of products. Andrey Dmitrievich supported us right away! Of course, we didn’t think that he could leave Arzamas - how could we live without him?! But from a certain point on, he wanted to leave... And his wife too, I mean Klavdiya Alekseevna... As I understand it, he felt that he had solved major problems and needed to change his field of activity. I was looking for a new application of forces... I do not belittle his role in the democratization of society, his political activities, but it is still a pity that he could not fully engage in science.

— **One question torments me: why didn’t the physicists in Arzamas-16 protest when Sakharov was exiled to Gorky?**

— Indeed, there were no protests, although everyone understood perfectly well that something wrong was happening . That’s why they didn’t sign letters against Andrei Dmitrievich, moreover, when he was in disgrace in Moscow, they came to him, talked, communicated... No, there was no civil cowardice. Still, we have always lived under the burden of responsibility, realizing that the country’s nuclear defense rests on our shoulders, regardless of what political storms occur on the “Mainland”. And, by the way, Sakharov understood this. I remember he returned from Gorky. There was a general meeting of the Academy. We - several people - stood and talked. Everyone worked at different times in Arzamas-16 . Suddenly someone takes me by the hand and says: “Yura.” I turn around. I didn't recognize him at first! Aged, gray-haired... “Lord, Andrei Dmitrievich, dear!” We hugged and started talking...

— **Did you harbor any grudges?**

- He understood everything, and he understood us well... You asked a difficult question. To be honest, there is no answer to this...

- And one more thing. The house where you live is opposite Sakharov’s house—the street separates it. NKVD officers with dogs led columns of prisoners along it. Every morning to work, and back in the evening. Did this influence you? In his memoirs, Sakharov only mentions the fact itself - the participation of prisoners in the creation of the “object”.

Yuri Trutnev. A few words about the future:

“If unity and the desire to jointly overcome the gigantic problems facing humanity (depletion of raw materials, food shortages, environmental crisis, spiritual impoverishment) prevail in the world , then the need for many types of national weapons will naturally disappear. If civilization is overwhelmed by the chaos of

“One evening I left my friends’ house and started crossing the street. I walked between the prisoners and the guard, and suddenly he attacked me with a carbine, completely brutalized... I remember these columns, the prisoners worked here until 1957 . I understand Sakharov, he did not want to talk or write about this in detail - this is a tragic part of our history, all of us, without exception. You need to know and remember, but you can’t savor it... They don’t talk about it, but they think about it... Everyone has something purely personal, their own. When Sakharov’s 70th birthday was celebrated, I refused to speak with my memoirs, because too many people today like to talk about their closeness to him... By the way, he knew how to sign with both hands - “A. Sakharov“... I remember once coming to work in a minor mood, this happened often. I went up to the board, started writing something , walked away and suddenly began

all kinds of conflicts, then the ideas of national (bloc) salvation will dominate, and in this case one can foresee the emergence of a new arms race, specific to the conditions of a multipolar world. It can be predicted that the United States will retain its nuclear forces for a long time, at least until real life shows which path global development will take. It would be appropriate for Russia to adhere to this approach, especially since it has everything necessary for this.”

reading Pushkin’s “Road Complaints”... It amazed me. This is one of my favorites: “How long can I walk in the world...” Andrei Dmitrievich was a great man, I mean - not a specialist, not a physicist, not a humanist, but a human being. He reminded me of a knight of conscience - the last authority that could resolve any disputes. If Sakharov said so, then it is so...

- And Khariton? What is characteristic of Yuliy Borisovich?

- The ability to get into the most subtle things. He often noticed things that others didn't notice. It seemed like he was doing small things! And then it turned out that this “little thing” grew into a huge problem. His motto: “We need to know ten times more than we do!” And he is, of course, right... One can only be amazed at his courage: the man devoted himself entirely to his work. One of the main features is the ability to persistently achieve a solution to the task that has been set. And we largely owe the creation of nuclear weapons in our country to Khariton.

- Don’t you regret what you’ve lived?

- No. There were both bad and good things in the life of our generation. I try to remember the best.

* * *

In 2002, the 75th anniversary of the birth of Academician Yu.A. was celebrated. Trutneva. To mark the anniversary, a monograph was published in which the scientist spoke about his work. For many decades they were strictly classified. Some of them are amazing...

For example, one of the works performed by Yu. Trutnev, Yu. Babaev and A. Pevnitsky in 1963 was called: “Stationary installation for producing active substances and electricity using nuclear and thermonuclear explosions.” In it, the authors wrote:

“ *A different approach to the problem of mastering nuclear energy is possible—the use of explosive-type processes for industrial purposes. Specially designed atomic and thermonuclear charges can find application in many branches of science and technology. What seems most tempting to us is the use of nuclear explosions to produce electricity and fissile substances...* “

Very little time will pass, and the future academician Yu.A. Trutnev will take direct part in the program for the use of nuclear explosions for peaceful purposes. The creation of an artificial lake in the desert and underground storage facilities, extinguishing gas and oil gushers, geophysical research and geological exploration and much more - all this allowed us to say that the “peaceful professions” of atomic weapons are quite real.

But the project proposed in 1963 was more daring:

“The explosion is carried out under such conditions that the released energy is concentrated in a limited volume of a substance and then removed by gradual cooling of this substance. It seems possible to create a special charge in which the neutrons released during the

In the project of an explosive thermonuclear reactor developed by Yu.A. Trutnev and his colleagues propose to obtain electricity and radioactive substances using small thermonuclear explosions that follow one after another. First, the explosion chamber is filled with a coolant - some gas, for example hydrogen. Then a charge is introduced into the chamber through a specially designed gateway and detonated. The energy released during the explosion heats the gas to 1000–1400°C , and the pressure in the chamber increases to 300 atm . The heated gas first passes through a heat exchanger,

explosion will be almost completely absorbed by uranium-238 or thorium-232 .

providing energy to the power plant, and then through a filter in which radioactive substances and other explosion products are extracted. The cooled and purified gas again enters the explosion chamber, and the next explosion is carried out.

When neutrons are absorbed, uranium-238 turns into plutonium-239 , and thorium-232 into uranium-233 ...”

In essence, we are talking about obtaining the “main” explosives, that is, the reproduction of unique materials. We explode plutonium and... we get the same plutonium in even larger quantities!

By the way, immediately after our first bomb test in August 1949, two great physicists G. Flerov and D. Frank-Kamenetsky proposed exploding atomic charges deep underground. It was assumed that the rocks would melt and for quite a long time there would be a temperature of about three thousand degrees. If you drill wells and pump water through this “atomic oven,” you can release energy to the surface. And when the rock cools completely, a new deposit of artificial elements - plutonium and uranium-233 - is formed underground .

But Trutnev and his co-authors did not agree with their predecessors and teachers:

> „ *In our opinion, carrying out explosions in a stationary installation (chamber) is a more realistic way of using nuclear and thermonuclear charges to generate electricity and active substances...*
>
> *Particularly interesting is the use of thermonuclear charges. They use cheap deuterium as a “combustible” material. Fissile substances are used only as a fuse for thermonuclear reactions...*
>
> *The use of thermonuclear explosions, apparently, is the most realistic way in the problem of mastering thermonuclear reactions, since the problem of releasing thermonuclear energy and neutrons has already been solved in the charges. Although the task of localizing explosions is difficult, these difficulties are not of a fundamental nature .*”

What is a facility for the production of fissile substances and electricity? This is a special chamber filled with coolant gas. A charge explodes in its center. The temperature of the gas rises to almost one and a half thousand degrees, and the pressure to 300 atmospheres. In the heat exchanger, the gas releases energy - within an hour the temperature drops three times, and the pressure also decreases sharply. You can make the next explosion...

The walls of the chamber are made of very durable material. Steel is best suited for this. The thickness of the wall is about five meters. The diameter of the chamber is 120 meters. In such a chamber it is possible to detonate a charge of approximately the same power that was dropped on Hiroshima.

The authors of the project studied different coolant options that can be used in such a superchamber. Even water sprayed into small particles, filling the entire volume, was studied. However, it had to be abandoned: creating such tiny droplets is technically difficult. Still, the primacy remains with hydrogen.

It is quite difficult to introduce new nuclear charges into the chamber - after all, its tightness cannot be violated. Therefore, the authors developed a special sluice device that allows the charge to be lowered on a cable into the very center of the explosion chamber. And this is done every hour. The creation of such a device is in itself unique.

A lot of ingenuity was required from scientists when developing a heat exchanger, a filter device, compressors, piping systems and even a power plant. According to calculations, it turned out that the power plant’s capacity would be about four million kilowatts.

The authors also worked on another option. In this case, the power plant capacity rose to 15 million kilowatts. That is, two such installations replace the entire nuclear power industry created in the USSR.

Fantastic project! Of course, there are a lot of technical problems. Thermonuclear charges as fuel - nothing like this has ever existed. But until quite recently nothing was known about

thermonuclear weapons themselves! Moreover, physicists were convinced that it was impossible to reproduce the processes occurring on the Sun under terrestrial conditions... However, artificial suns were lit at nuclear test sites, why can’t they be used for the benefit of people, and not for destruction?!

Yu. Trutnev and A. Pevnitsky were required to conduct an economic feasibility study for the project. And in 1964, another secret work appeared, in which scientists give economic assessments of their proposals.

In particular, they claim:

> „ *Attempts to implement a controlled thermonuclear reaction encounter a number of fundamental difficulties, and it is unlikely that an industrial power plant will be created on its basis in the near future. Much greater progress has been achieved towards the creation of systems in which the expanded reproduction of nuclear fuel is carried out. Breeder reactors using fast neutrons have already been designed and are successfully operating , with a breeding factor significantly greater than one.*
>
> *In our opinion, it is quite realistic and, perhaps, promising, especially during the period of gradual transition of energy to nuclear fuel, to obtain electricity and active substances through repeated explosions of thermonuclear charges in a stationary installation...* “

A new term is being born: the authors propose calling such a facility “explosive thermonuclear reactor - VTR.”

Economic calculations of the operation of VTR show that by using special charges it is possible to achieve that the active substance will be completely replenished, and in this case the price of the generated electricity will be comparable to the cost of energy generated at a nuclear power plant.

In the 1960s , the project proposed by Arzamas-16 scientists was not implemented. Soon all nuclear explosions, both military and peaceful, came under an international ban. The Americans, who were far behind our scientists and designers in this area, did everything possible to first slow down and then completely stop such work in Russia. And now the daring and original projects of our scientists have fallen into the category of “fantastic”.

Maybe we will still learn to light up the earthly stars we need so much?!

" Science and life "

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To the main page